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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
UHLIR, NIKOLAS J	
ART UNIT	**PAPER NUMBER**
1773	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/812,515	Applicant(s) MUKAI ET AL.
	Examiner Nikolas J. Uhlir	Art Unit 1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 June 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,13 and 21-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6, 13, and 21-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to the request for continued examination (RCE) dated 06/25/2004. Applicant's amendment and arguments have been fully considered but are not persuasive in overcoming the previously cited prior art. Currently, claims 1-6, 13, and 21-26 are pending.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims, 1-4, 6, 21-22, and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lal et al. (US5580667) in view of Bertero et al. (US6150015).

4. Claim 1 requires a layered polycrystalline structure comprising a seed crystal layer containing a non-magnetic element; a magnetic crystal layer containing a non-magnetic element diffused along a grain boundary, said magnetic layer including a part completely excluding a non-magnetic element out of a lattice of the magnetic crystal layer; and a non-magnetic crystal layer between the seed crystal layer and the magnetic crystal layer, wherein the non-magnetic crystal layer contains a non-magnetic element at a first concentration level near the seed crystal layer and at a second concentration level smaller than the first concentration level near the magnetic layer.

5. It is noted that the requirement, "said magnetic layer includes a part completely excluding a non-magnetic element out of a lattice of the magnetic crystal layer," is read on by any magnetic layer that does not contain every known non-magnetic element. The requirement that the layer include "a part" excluding "a" non-magnetic element from

the lattice merely requires one of any of the known non-magnetic elements to not be present in some portion of the lattice of the magnetic layer. The claim language does not require the non-magnetic element diffused along the grain boundary to be the same as the non-magnetic element excluded from the lattice. Therefore, if a magnetic layer is composed of only magnetic elements or does not contain at least one of the known non-magnetic elements, it reads on the claim.

6. Bearing the above interpretation in mind, Lal et al. (Lal) teaches a magnetic recording medium comprising a substrate 22, and a sputtered crystalline underlayer 24, a gradient layer 25, and a first magnetic layer 30 formed in this order from the substrate (figure 1 and column 3, line 55-column 4, line 3). The sputtered crystalline underlayer is made of Cr (column 4 lines 19-25) and is considered by the examiner to be equivalent to the applicants claimed seed crystal layer containing a non-magnetic element. The magnetic layer 30 is a Co based alloy that comprises an alloy of Co with one or more of the elements Ni, Pt, Nb, Cr, Ta, V, W, B, Zr, Si, Hf, and P, with exemplary alloys including CoCrTa, CoCrPt, CoCrNi, CoCrTaPt, CoCrTaNi, CoCrTaPtB, and CoNiPt (column 4, lines 36-50). As these magnetic layers do not contain every known magnetic element, the examiner considers them to be equivalent to applicants claimed magnetic layer including at least a portion completely excluding a non-magnetic element from the lattice.

7. The gradient layer at the boundary of the Cr underlayer and the Co based magnetic layer exhibits an axial composition gradient, wherein the gradient layer contains progressively more of the alloy composition of the magnetic layer and

progressively less of the underlayer Cr metal as the film progresses in the direction from the Cr underlayer to the magnetic layer. It is the examiners position at some portion of this gradient layer is equivalent to applicants claimed non-magnetic crystal layer, as the layer progresses from pure crystalline Cr at the boundary between the Cr underlayer and the gradient layer (Cr is known to be non-magnetic) to pure Co based magnetic alloy at the boundary between the gradient layer and the magnetic layer. Thus, the gradient layer necessarily possesses an area that contains a large amount of Cr (equivalent to applicants claimed first concentration level) near the underlayer, and contains progressively less Cr as the layer approaches the Co based magnetic layer.

8. However, Lal does not teach that non-magnetic element is diffused along the grain boundary of the magnetic layer, as required by claim 1.

9. With respect to this deficiency, Bertero et al. (Bertero) teaches that the signal to noise ratio of a magnetic layer can be improved by segregating the crystal magnetic grains with a segregant material, such as a Cr (column 2, lines 4-10).

10. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a CoCr based alloy as the magnetic layer in Lal, such that the Cr in the alloy segregates the magnetic crystal grains.

11. One would have been motivated to make this modification in light of the teaching in Bertero that the signal to noise ratio of a magnetic layer can be improved by segregating the crystal grains in the layer with a non-magnetic material such as Cr. One would have specifically selected a CoCr based alloy as the Co based magnetic layer of

Lal in light of the fact that Lal recognizes the equivalence of CoCr alloys to the other materials listed as suitable for forming the magnetic layer.

12. Claim 2 requires the seed crystal layer to contain Cr in an amount of ≥50 atomic %, the magnetic layer to comprise a Co based alloy having Cr atoms diffused in the grain boundary, said Co-based alloy magnetic crystal layer including a part completely excluding Cr atoms out of a lattice of the magnetic crystal layer; and the non-magnetic layer to comprise a Co based alloy non-magnetic crystal layer containing Cr atoms at a first concentration nears the seed layer and a second concentration smaller then the 1st concentration near the magnetic layer.

13. For clarity, the examiner interprets the limitation "including a part completely excluding Cr atoms out of a lattice of the magnetic crystal layer" to be read on by any CoCr alloy based magnetic layer that has been treated so as to diffuse Cr from the magnetic grains into the grain boundaries (as is taught in Bertero). The language, including "a part" completely excluding Cr atoms merely requires some portion (which could be infinitesimally small) of the lattice of a Cr containing magnetic alloy to be devoid of Cr. IF Cr is diffused from the crystal lattice of the magnetic grains into the grain boundaries, at least the portions of the lattice from which the Cr diffused will be devoid of Cr.

14. Bearing this interpretation in mind, the limitations of claim 2 are met as set forth above for claim 1. When the CoCr based alloy of Lal is heat-treated to diffuse Cr into the grain boundaries (as taught by Bertero), at least some portion (though very likely a tiny portion) of the lattice of the CoCr magnetic grains will be devoid of Cr.

15. Claim 3 requires the seed layer to be pure Cr. This limitation is met as set forth above for claim 1.

16. Claim 4 requires the same limitations as claim 1, except for the recitation that the structure is a magnetic recording medium. These limitations are met as set forth above for claim 1.

17. Claim 6 requires a Ti layer to be defined along the surface of the substrate. Lal teaches that a metal layer is preferably formed on the substrate prior to forming the Cr underlayer. The metal layer is typically formed form Ti, V, W, Si, Mo, Nb, Ag, B, Al, Gd, or Ni/P, with Ti being preferred (column 5, line 63-column 6, line 5).

18. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a Ti layer between the substrate and the Cr underlayer taught by Lal.

19. One would have been motivated to select Ti for this purpose as Lal recognizes Ti to be equivalent to the other materials listed as suitable for forming this layer.

20. Claim 21 requires the magnetic crystal layer to have crystal grains equal to the size of the grains in the non-magnetic layer. Although Lal does not expressly teach this limitation, Bertero teaches that a sputtered magnetic layer in a magnetic recording medium epitaxially grows over the grains of the layer upon which it is deposited. Thus, the size of the magnetic grains is controlled by the size of the underlayer grains (column 14, lines 1-27). Thus, in light of the teaching that the grains of the magnetic layer epitaxially grow over the grains of the nucleation layer, and that the grain size of the nucleation layer controls the grain size of the magnetic layer, the examiner takes the

position that the magnetic layer grains in Lal will be of equal size to that of the gradient layer grains. Thus, the limitations of claim 21 are met.

21. Claim 22 requires the non-magnetic crystal layer to have an epitaxial relationship to the seed layer. As established above for claim 21, sputtered deposited layers in magnetic recording media epitaxially grow over crystalline layers upon which the sputter deposited layer is deposited. Thus, the examiner takes the position that this limitation is met, although it is not expressly taught.

22. Claim 24 requires the non-magnetic crystal layer to have a concentration gradient of the non-magnetic element from the first concentration level to the second concentration level. This limitation is met as set forth above for claim 1.

23. Claim 25 requires the magnetic element to contain the non-magnetic element at a concentration level equal to the second concentration level along the grain boundary. Although this limitation is not expressly taught, Bertero teaches that grains in a CoCr based alloy magnetic layer are segregated by "excess Cr" in the alloy (column 14, lines 1-7). Lal teaches that the gradient layer contains progressively more Co based alloy and progressively less Cr from the underlayer as the layer progresses away form the underlayer (column 4, lines 25-35). Therefore, the excess Cr in the alloy magnetic layer at the point at which the magnetic layer and the gradient layer meet will logically be the amount of chromium from the underlayer remaining in the upper portion (second area) of the gradient layer. Thus, as Bertero clearly teaches that "excess Cr" in the alloy separates the grains in a CoCr based alloy, it is the examiners position that the amount of Cr in the grain boundaries of the Co based magnetic layer will be equivalent to the

amount of Cr in the upper portion of the gradient layer. Thus, the limitations of claim 25 are met.

24. Claim 26 requires the part of the magnetic crystal layer of claim 1 that completely excludes a non-magnetic element to be a magnetic grain. This limitation is met as set forth above for claim 1. The magnetic grains of the magnetic recording layer of Lal do not contain each and every known non-magnetic element. Accordingly, these grains completely exclude "a" non-magnetic element.

25. Claims 5, 13, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lal in view of Bertero as applied to claim 1 above, and further in view of Okumura et al. (US5700593).

26. Lal as modified by Bertero above fails to teach the limitation in claim 5 requiring an amorphous layer to be formed between the substrate and the seedlayer.

27. With respect to this deficiency, Okumura et al. teaches that the crystal grains of a magnetic recording medium can be refined by forming a non-magnetic amorphous metal layer on the surface of a substrate prior to the deposition of any other non-magnetic or magnetic layers (column 2, lines 38-65). Suitable materials for forming the non-magnetic amorphous layer include pure Cr, pure V, pure Ti, or a Cr, V, or Ti alloy having an alloy composition providing an amorphous structure (column 4, lines 15-20).

28. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to form a non-magnetic amorphous Ti layer as taught by Okumura et al. between the substrate and the Cr underlayer utilized by Lal as modified by Bertero.

29. One would have been motivated to make this modification due to the teaching in Okumura et al. that the grain size of a magnetic recording medium can be improved through the deposition of a non-magnetic amorphous layer on the surface of a substrate prior to the deposition of other magnetic or non-magnetic layers. One would have specifically been motivated to choose Ti as the non-magnetic amorphous material due to the teaching of the equivalence of Ti to the other materials listed as suitable for use as the amorphous non-magnetic crystal layer by Okumura et al. Further, a Ti coating is listed by Lal as a preferred material for coating a substrate prior to coating the Cr underlayer.

30. Claim 13 requires a layered polycrystalline structure comprising amorphous nucleation sites physically separated on a surface of a substrate, each of said amorphous nucleation sites being made of an aggregation of predetermined atoms, and a crystal layer covering the surface of the substrate and containing crystal grains growing from the nucleation sites.

31. Regarding these limitations, Lal as modified by Bertero and Okumura as set forth above clearly teaches the advantages of forming an amorphous Ti layer on the surface of the substrate prior to forming the crystalline Cr underlayer. Further, Lal teaches that the Ti coating is preferably 50-200 angstroms thick (column 5, line 63-column 6, line 5).

32. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to form a 50angstrom thick Ti layer over the subtrate taught by Lal, as Lal specifically teaches that this is a suitable thickness for the Ti layer.

33. While Lal as modified by Bertero and Okumura does not teach the applicants requirement of a amorphous nucleation sites spaced apart from one another, it is the examiners position that this 50 angstrom (5nm) thick layer meets this limitation, as the applicant in his arguments dated 7/28/03 admits that layers that are >10nm thick form continuous layers, which logically leads to the conclusion that layers less then 10nm thick are discontinuous. Thus, given this admission (which is echoed by the Okumura at column 5, lines 15-20), it is the examiners position that the 5nm thick it layer meets the applicants requirement of the formation of nucleation sites spaced apart from one another as it will be a discontinuous layer and thus necessarily have individual sites separated from one another.

34. Further, it is noted that the combination of Lal with Bertero and Okumura does not expressly teach the applicants limitation requiring a crystalline layer to be growing from the nucleation sites. However, given that Bertero teaches that sputter deposited layers epitaxially grow over layers on which they are deposited, and given that a crystalline Cr layer is deposited on the amorphous Ti layer, the examiner takes the position that this limitation is met.

35. Claim 23 requires at least the surface of the substrate to be amorphous. Lal teaches that the substrate can be made form materials such as glass, carbon, silicon, glass-ceramic, or ceramic (column 5, lines 40-52).

36. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a glass substrate as the substrate in Lal as modified

by Bertero and Okumura, as Lal recognizes the equivalence of glass to the other materials listed as suitable for this purpose.

37. It is the examiners position that the limitations of claim 23 are met when a glass substrate is utilized, as glass is a known amorphous material.

38. The examiner acknowledges that Lal states that some substrates are initially formed as an amorphous glass and then heat-treated to form a crystalline ceramic phase. However, the examiner reads this passage in Lal as referring to the glass-ceramic type substrates listed as suitable, and not simply a glass substrate.

Response to Arguments

39. Applicant's arguments filed 06/25/2004 have been fully considered but they are not persuasive. Applicant's initial arguments are directed towards the new requirement that at least a portion of the magnetic layer lattice exclude a non-magnetic element. As stated above, the requirement that "a" portion of the "a" lattice completely exclude "a" non-magnetic element is very broad. All this language requires is for one of the known non-magnetic elements to be excluded from some portion of "a" lattice in the magnetic layer. The language utilized by the applicant does not require the non-magnetic element contained in the magnetic layer to be the same as the non-magnetic element the is completely excluded from "a" portion of "a" lattice in the magnetic layer. As the magnetic layer of Lal does not contain each and every known non-magnetic element, it reads on the claim language of claim 1 and its dependant claims. Further, the language of claim 2 only requires an infinitesimally small portion of the magnetic layer lattice to exclude Cr. Thus, Lal as modified by Bertero reads on claim 2 and its dependants, as at least some

portion of the lattice of CoCr based magnetic layer that has been heat treated to diffuse Cr from the grains into the grain boundaries will be devoid of Cr. Thus, applicant's arguments with respect to the newly required "completely excludes a non-magnetic element" are unpersuasive.

40. Applicant then reiterates their arguments against the rejection of claims 5, 13, and 23 as being obvious over Lal in view of Bertero and Okumura. The examiner maintains his response to this argument that was set forth in the final office action dated 3/22/04 (see sections 39-41). Accordingly, this argument is unpersuasive.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 571-272-1517. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul J. Thibodeau can be reached on 571-272-1516. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

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